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Brief Report

Are hallux valgus and big toe pain associated with impaired quality of life? A cross-sectional study

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SUMMARY

Hallux valgus (HV) is common with a standardised prevalence of 28.4% in adults older than 40 years. It has been shown to associate with impaired quality of life (QOL) in small hospital based studies. Previous studies of association between HV, function and disability are based on the presence or absence of regional foot pain which may be due to other foot pathology and is not specific to HV. The objective of this study is to examine the association between self reported HV, big toe pain and impaired QOL in a primary care population. We hypothesise that presence of self-reported HV alone, big toe pain alone and both together will associate with progressively impaired QOL. This hypothesis is based on the known association of concurrent HV and foot pain with impaired physical function and the fact that foot pain and not foot deformity impairs functional status. Our study shows that concurrent HV and big toe pain but not isolated HV associates with impaired overall satisfaction with health and low score on the physical, psychological and social domains of World Health Organization Quality of Life-BREF (WHOQOL-BREF).

Short communication

Hallux valgus (HV) is common with a standardised prevalence of 28.4% in adults older than 40 years[1]. It has been shown to associate with impaired quality of life (QOL) in small hospital[2–4] based studies. Previous studies of association between HV, function and disability are based on the presence or absence of regional foot pain which may be due to other foot pathology and is not specific to HV[5–7]. The objective of this study is to examine the association between self-reported HV, big toe pain and impaired QOL in a primary care population. We hypothesise that presence of self-reported HV alone, big toe pain alone and both together will associate with progressively impaired QOL. This hypothesis is based on the known association of concurrent HV and foot pain with impaired physical function[5] and the fact that foot pain and not foot deformity impairs functional status[6,7]. Our study shows that concurrent HV and big toe pain but not isolated HV associates with impaired overall satisfaction with health and low score on the physical, psychological and social domains of World Health Organization Quality of Life-BREF (WHOQOL-BREF).

Method, results and discussion

Study design and participants

A cross-sectional study approved by Nottingham Local Research Ethics Committee 2 was undertaken in two general practices in Nottingham. Each practice drew up a list of all registered men and women aged over 30 years, excluding those with a history of major psychiatric disease, dementia or recently diagnosed malignancy. A questionnaire was mailed to all listed individuals with a pre-paid reply envelope.

HV and big toe pain classification

HV was assessed using a previously validated line-drawing instrument which consists of five drawings for each foot illustrating a normal foot without HV and four drawings which show sequentially increasing HV angles of 15°[8]. Participants were asked to select which drawing most resembles each of their feet. HV was

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dichotomised as present or absent by classifying the three most severe grades, as present, and others as absent[8]. This dichotomised HV scale has a weighted kappa value of 0.55 (0.49–0.61) for subject–observer agreement[8].

Participants reporting HV in either foot were classified as having HV. Participants reporting pain in either big toe on most days of a month for at least 1 month in the previous year were classified as having big toe pain. Depending on the presence of self-reported HV and big toe pain, participants were classified as: no HV and no big toe pain, HV alone, big toe pain alone, and both HV and big toe pain.

QOL measure

A validated generic health assessment instrument (WHOQOL-BREF) was used to produce a QOL profile[9]. This instrument assesses overall perception of QOL and overall satisfaction with health with the following: (1) 'How would you rate your QOL?' and (2) 'How satisfied are you with your health?' Scores scaled in a positive direction range from 1 to 5. Twenty-four further questions relate to four domains of QOL: physical (seven), psychological (six), social (three) and environment (eight). Domain scores scaled in a positive direction range from 4 to 20.

Risk factors and co-morbidities

The questionnaire enquired about age, gender, highest education (none, primary school, secondary school, college/university), self-reported height (feet and inches) and weight (stones and pounds). It asked whether participants had ever been diagnosed with high blood pressure (hypertension), high levels of fats, lipids or cholesterol in the blood (hyperlipidaemia), diabetes, heart attack (myocardial infarction), angina, stroke, mini-stroke (transient ischaemic attack), osteoarthritis, rheumatoid arthritis (RA) or ankylosing spondylitis by a doctor. It asked whether participants had had a hip or knee replacement. Participants were asked if they had knee pain on most days of a month for at least 1 month within the last year[10].

Participants were defined as having osteoarthritis if they self-reported osteoarthritis at any site, had nodal osteoarthritis or underwent joint replacement surgery in the absence of self-reported RA or ankylosing spondylitis. Self-reported nodal osteoarthritis was assessed using a previously validated line-drawing instrument showing typical nodes and describing them as a firm swelling at the back of an interphalangeal joint[11]. Participants were asked to indicate joints which had such swellings. Nodal osteoarthritis was defined as the presence of Heberdens' and/or Bouchards' nodes in at least two rays of each hand.

The number of general co-morbidities (0–5) was calculated based on presence of self-reported physician-diagnosed diabetes mellitus, ischaemic heart disease (myocardial infarction or angina), cerebro-vascular disease (stroke or transient ischaemic attack), hypertension and hyperlipidaemia. Similarly, the number of musculoskeletal co-morbidities (0–3) was calculated based on presence of self-reported osteoarthritis, RA and knee pain.

Statistical analysis

Data about height and weight was converted to cm and kg. Body mass index (BMI) was calculated using self-reported height and weight. Comparison was made among four groups: no HV and no big toe pain, HV alone, big toe pain alone, and both HV and big toe pain. One-way analysis of variance (ANOVA) was used for continuous data and chi-square test was used for dichotomous/categorical data. General linear model (analysis of covariance) was used to establish the presence of progressively impaired QOL from no HV and no big toe pain, to HV alone, big toe pain alone, and both HV and big toe pain after adjusting for age (years), gender (female 1, male 0), BMI (kg/m^2), number of musculoskeletal (0–3) and number of general co-morbidities (0–5). 95% confidence interval (CI) was used to compare the differences between the four groups.

Adjusted odds ratio (aOR) (95% CI) was used to estimate the relative risk of impaired QOL between groups. Impaired QOL was defined as a QOL score which was less than the median for each component of WHOQOL-BREF. Binary logistic regression was used to adjust for age (tertile), gender (female 1, male 0), BMI (tertile), university/college education (yes 1, no 0), number of general (0–5) and musculoskeletal co-morbidities (0–3). Statistical analyses were performed using SPSS v14 (SPSS, Chicago IL, USA). Statistical significance was set at $P \leq 0.05$.

Demographic details

Questionnaires were mailed to 13,684 individuals. 3082 responses were received (23%). The mean age of participants was 57.96 (S.D. 14.33) year and 57.4% were female. Due to incomplete responses for HV ($n = 278$) and big toe pain ($n = 183$), 427 participants could not be classified into any group. Fifty-eight subjects were excluded from analysis of QOL because >5 responses were missing (per WHOQOL-BREF manual). Due to incomplete response on individual domains, QOL analysis could not be carried out for physical, psychological, social and environmental domains of WHOQOL-BREF on 25, 11, 53 and six participants respectively (per WHOQOL-BREF manual). Participants not classified in a group or excluded from analysis of QOL were older [63.20 (14.49) vs 57.06 (14.11) year; $P < 0.001$] and were less likely to have received a university/college education (25.7% vs 42.8%; $P < 0.001$). Participants with HV were more likely to be older, be female, have musculoskeletal co-morbidities and were less likely to have received university/college education (Table I).

HV, big toe pain and WHOQOL-BREF scores

There was a trend towards progressively impaired QOL for participants with HV alone, big toe pain alone and both together on each component of WHOQOL-BREF after adjusting for age, gender and BMI (Table I). This trend for progressively impaired QOL remained significant for overall satisfaction with health ($P < 0.001$) and for physical ($P = 0.008$), psychological ($P = 0.009$), social ($P = 0.024$) and environmental ($P = 0.009$) domains of WHOQOL-BREF after adjusting for age, gender, BMI, number of general and number of musculoskeletal co-morbidities.

Participants with concurrent HV and big toe pain, and big toe pain alone had significantly worse overall satisfaction with health compared to those without HV or big toe pain and those with HV alone after adjusting for age, gender, BMI, number of general and musculoskeletal co-morbidities. Participants with both HV and big toe pain had significantly lower QOL scores on all domains of WHOQOL-BREF than those with no HV and no big toe pain. They also had significantly lower scores for environmental domain of WHOQOL-BREF than those with HV alone. These differences persisted after adjusting for age, gender, BMI, number of general and musculoskeletal co-morbidities.

The presence of HV and big toe pain associated with impaired overall satisfaction with health and impaired score on physical, psychological and social domains of WHOQOL-BREF (Table II).

Table I
Demographic features and WHOQOL-BREF score (adjusted for age, gender and BMI) for individual groups*

	No HV and no big toe pain, $n = 1778$	HV only, $n = 686$	Big toe pain only, $n = 82$	Big toe pain and HV, $n = 109$	P†
Age (years)	54.60 (53.95–55.25)	62.58 (61.56–63.61)	58.18 (55.75–60.60)	64.25 (62.06–66.44)	<0.001
BMI (kg/m^2)	26.27 (26.07–26.48)	25.87 (25.51–26.22)	26.70 (25.72–27.68)	26.30 (25.41–27.19)	0.156
Female, %	51.8	69.6	48.8	79.0	<0.001
Tertiary education, %	46.2	36.0	25.9	37.7	<0.001
Knee pain, %	15.9	26.4	51.9	58.1	<0.001
Self-reported RA, %	2.0	6.0	9.8	12.8	<0.001
Self-reported OA‡, %	13.7	26.2	24.4	39.8	<0.001
Nodal OA, %	4.1	11.0	12.2	18.4	<0.001
Hip or knee replacement, %	2.5	4.4	3.8	3.8	0.128
Overall perception of QOL	4.10 (4.07–4.14)	4.09 (4.04–4.15)	4.08 (3.93–4.23)	4.02 (3.88–4.15)	0.044
Overall satisfaction with health	3.61 (3.56–3.65)	3.61 (3.54–3.68)	3.30 (3.12–3.49)	3.32 (3.15–3.49)	<0.001
Physical	16.11 (15.97–16.24)	15.70 (15.48–15.92)	14.93 (14.34–15.52)	14.68 (13.94–14.99)	<0.001
Psychological	15.15 (15.05–15.26)	14.88 (14.70–15.06)	14.64 (14.15–15.14)	14.14 (13.7–14.57)	<0.001
Social	15.42 (15.28–15.57)	15.20 (14.96–15.43)	14.75 (14.10–15.40)	14.43 (13.86–15.00)	0.002
Environmental	16.03 (15.93–16.13)	15.88 (15.72–16.05)	15.60 (15.14–16.05)	15.06 (14.66–15.45)	<0.001

* Table shows mean (95% CI) for continuous variables and % for categorical variables.
† Calculated using ANOVA for age and BMI; chi-square test for categorical data and analysis of covariance for WHOQOL-BREF scores. Analysis of covariance yields P for linear trend.
‡ Proportion of participants with any of the following: (1) self-reported osteoarthritis (OA) at any site, (2) nodal OA, (3) hip or knee replacement in the absence of self-reported RA or ankylosing spondylitis.

Comments

This is the first study to specifically assess the association between HV, big toe pain and QOL in community dwelling adults. This study shows that concurrent HV and big toe pain but not isolated HV associates with impaired overall satisfaction with health and low scores on physical, psychological and social domains of WHOQOL-BREF. Our *a priori* hypothesis that there would be a progressively impaired QOL in participants with HV alone, big toe pain alone and both together were confirmed.

Table II
Multivariable analysis of predictors of impaired QOL: aOR (95% CI) for impaired overall perception of QOL, overall satisfaction with health, and individual domains of WHOQOL-BREF*,†

	aOR (95% CI)‡	P
Overall perception of QOL		
HV only	1.03 (0.82–1.28)	0.829
Big toe pain only	0.85 (0.50–1.45)	0.557
HV and big toe pain	1.56 (0.91–2.68)	0.104
Overall satisfaction with health		
HV only	0.98 (0.79–1.21)	0.823
Big toe pain only	1.82 (1.12–2.94)	0.015
HV and big toe pain	1.84 (1.18–2.86)	0.007
Physical domain		
HV only	1.49 (0.93–1.42)	0.199
Big toe pain only	1.22 (0.74–2.01)	0.445
HV and big toe pain	1.80 (1.12–2.90)	0.016
Psychological domain		
HV only	1.08 (0.89–1.32)	0.430
Big toe pain only	1.64 (1.01–2.69)	0.048
HV and big toe pain	1.70 (1.08–2.69)	0.022
Social domain		
HV only	1.15 (0.94–1.40)	0.173
Big toe pain only	1.42 (0.89–2.25)	0.142
HV and big toe pain	1.65 (1.08–2.52)	0.020
Environmental domain		
HV only	0.99 (0.82–1.21)	0.943
Big toe pain only	1.00 (0.63–1.60)	0.993
HV and big toe pain	1.33 (0.87–2.04)	0.195

* Adjusted for age (tertile), gender (female 1, male 0), BMI (tertile), education (attended college or university: yes 1, no 0), number of general (0–5) and musculoskeletal co-morbidities (0–3).
† Impaired QOL: defined as QOL score below the 50th centile for individual component of WHOQOL-BREF.
‡ No HV and no big toe pain is the referent category.

The influence of HV and big toe pain on QOL might be explained by their effect on activities of daily living and social interaction. HV associates with impaired balance[11,12] and gait[13]. Foot pain associates with functional impairment[6,7], disability[7] and participation restriction[14].

Our findings are similar to those from previously published studies of association between HV and impaired QOL[2–4]. Small hospital based studies show that symptomatic HV associates with lower score on bodily pain[2–4], general health, physical function and physical role subscale of short form-36 (SF-36)[3]. These studies are limited by: small sample size[2]; selective ascertainment of patients attending specialist clinics[2–4], awaiting foot surgery[3,4] and lack of information about musculoskeletal co-morbidities[2,3]. These studies exclude cases with hallux rigidus[2], inflammatory arthritis[3] or radiographic osteoarthritis of the first metatarsophalangeal joint[4]. In one study, increasing HV angle associated with impaired QOL on general and mental domains of SF-36[2]. However, this was not supported by other studies[3,4].

In a community based study participants with at least moderate HV (HV angle $> 25^\circ$) had impaired general functional status on the physical function domain of SF-36[5]. Similar to the findings of our study, participants with HV and foot pain had even lower general functional status than participants with HV and no foot pain[5]. However there was no association between the presence of at least moderate HV and physical disability assessed on the role physical domain of SF-36[5].

To our knowledge, there is no defined threshold at which differences in WHOQOL-BREF scores become clinically significant across diseases. However, the significant reduction of QOL in people with HV and big toe pain identified by our study is supported by evidence from the general population[15], and is comparable to that of severe knee and hip OA awaiting joint replacement surgery[16].

Our study benefits due to recruitment from primary care, inclusion of both genders, all ages (range: 30–95 year), cases with musculoskeletal co-morbidities and information specific to big toe pain. Several caveats apply to these findings. Information about laterality of big toe pain was not collected. Although a significant limitation, it is an improvement on previous studies which use information about foot pain[5–7]. All information was self-reported.

This is an important limitation as musculoskeletal and general co-morbidities are poorly reported. As no physical examination was performed, findings were not adjusted for other painful foot conditions and self-reported co-morbidities were not validated. The low response rate to postal questionnaire raises possibility of differential response between those with and without symptomatic musculoskeletal conditions. Potential non-response bias limits our conclusions. Participants who could not be classified into any group were older and less likely to have received university/college education. This limits the generalisability of our findings. Although data were adjusted for knee pain, we were unable to adjust for pain at other sites e.g., back.

Conclusion

As this is the first study of association between HV, big toe pain and QOL in community dwelling adults, the results need to be confirmed. Our findings suggest that self-reported HV and big toe pain but not HV alone associates with impaired QOL.

Author contributions

All authors have made *substantial contributions to* the conception and design of the study, analysis and interpretation of data, drafting and revising the article and final approval of the version submitted. Collection and assembly of data were done by Dr Edward Roddy and statistical analysis was guided by Dr Weiya Zhang. Professor Michael Doherty (michael.doherty@nottingham.ac.uk) takes responsibility for the integrity of the work as a whole, from inception to finished article.

Conflict of interest

The authors did not receive any financial assistance from or have any personal relationships with other people or organisations that could inappropriately influence (bias) their work.

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